Alpha Pulse-Height Analysis

Alpha pulse-height analysis (APHA) can distinguish and measure specific alpha-emitting isotopes in a sample.

Principle of Technique

A silicon, surface-barrier, alpha-particle detector and a multichannel analyzer record the number and energy of the alpha particles emitted from the sample. The resulting spectrum is resolved for the emitting isotopes, and the peak areas are proportional to the concentrations of each isotope. The sample is counted in a vacuum chamber to minimize absorption of the alpha particles in air.

Samples

Form. Aqueous solutions.

Size. 1 mL or less.

Preparation. Sample solution is evaporated to residue on a counting planchette.

Counting equipment and data analysis system used for APHA.

Limitations

^{241}Am must be separated from the other isotopes by ion exchange. A detection limit of 10^{-15} Ci/sample is possible with 16 to 24 h counting times. The typical range is 10^{-11} to 10^{-7} Ci/sample.

Capabilities of Related Techniques

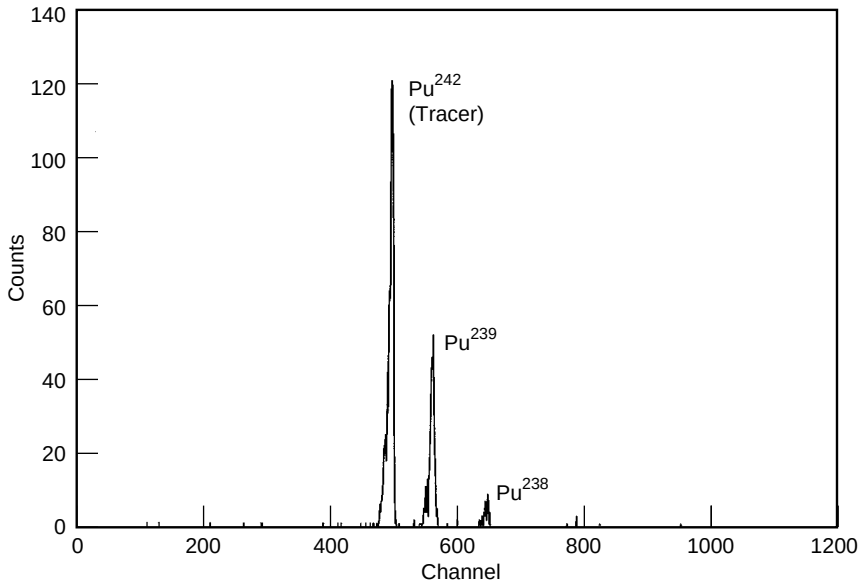
Gross alpha counting is simpler and faster, but cannot distinguish among several alpha-emitting isotopes.

Elemental analysis by emission spectroscopy or mass spectrometry may be applicable; however, emission spectroscopy cannot distinguish specific isotopes.

Examples of Applications

- Measurement of the isotopes ^{235}U, ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{252}Cf in weapons-grade material.

Plutonium analysis by α spectrometry. Soil sample taken in Livermore Valley (counting time, 16.64 h).



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